

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
28 January 2010 (28.01.2010)

PCT

(10) International Publication Number  
WO 2010/010475 A2

- (51) International Patent Classification:  
A01N 31/04 (2006.01) A01N 25/02 (2006.01)
- (21) International Application Number:  
PCT/IB2009/052871
- (22) International Filing Date:  
1 July 2009 (01.07.2009)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
12/179,382 24 July 2008 (24.07.2008) US
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:  
— without international search report and to be republished upon receipt of that report (Rule 48.2(g))

(54) Title: FOAMING ALCOHOL COMPOSITIONS WITH SELECTED DIMETHICONE SURFACTANTS

(57) Abstract: Foaming alcohol compositions with selected dimethicone surfactants are disclosed. The dimethicone surfactants are PEG-8 to PEG-12 linear dimethicone surfactants and in particular PEG-10 linear dimethicone surfactant. The compositions are useful as antimicrobial products and in particular handcare or skincare products.

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## FOAMING ALCOHOL COMPOSITIONS WITH SELECTED DIMETHICONE SURFACTANTS

### FIELD OF THE INVENTION

5           Foaming alcohol compositions with selected dimethicone surfactants are disclosed. The dimethicone surfactants are PEG-8 to PEG-12 linear dimethicone surfactants and in particular PEG-10 linear dimethicone surfactant. The compositions are useful as antimicrobial products and in particular handcare or skincare products.

10

### BACKGROUND

Alcohol compositions are desirable hand and skincare products. They are effective against a wide range of microorganisms such as gram positive and gram negative bacteria and fungi. And they are able to kill microorganisms faster than other antimicrobial products. Alcohol antimicrobial products are available as water  
15 thin liquids, gels, emulsions, and aerosol foams. Commercially available aerosol alcohol foams, such as QUIKCARE™, commercially available from Ecolab Inc. (St. Paul, Minnesota) rely on propellants to generate the foam. Propellants are needed because the surface tension of alcohol is too low for most surfactants to be able to generate foam and sustain it at atmospheric pressure. But, aerosol products are less  
20 desirable because of their inherent drawbacks of not being able to visually monitor the product contents in the container, the additional packaging complexity, and cost. It is desirable to move away from aerosol cans and aerosol propellants to less complex packaging and chemistry that allows a customer to see the product contents

in the container while maintaining the aesthetic benefits of a foaming product. It is against this background that the present invention has been made.

### SUMMARY

5 Surprisingly, it has been discovered that PEG-8 to PEG-12 linear dimethicone surfactants and in particular PEG-10 linear dimethicone surfactant are especially effective at generating foam in alcohol products at atmospheric pressure in transparent or translucent, non-aerosol packaging. The PEG-8 to PEG-12 linear dimethicone surfactants are more effective than dimethicone surfactants with the  
10 same PEG chain length but a different polymer architecture.

In some embodiments, the invention relates to a non-aerosol antimicrobial composition with a PEG-8 to PEG-12 linear dimethicone surfactant, an alcohol, and water, where the dimethicone can generate an average foam height of greater than 20 mm without needing more than 5% of additional surfactant. In some  
15 embodiments, the invention relates to a non-aerosol antimicrobial composition with a PEG-10 linear dimethicone surfactant, an alcohol, and water, where the dimethicone can generate an average foam height of greater than 20 mm without needing more than 5% of additional surfactant. In some embodiments, the composition also contains additional materials such as skin conditioners, terpenoids,  
20 chelating agents, and preservatives.

These and other embodiments will be apparent to those of skill in the art and others in view of the following detailed description of some embodiments. It should be understood, however, that this summary, and the detailed description illustrate

only some examples of various embodiments, and are not intended to be limiting to the invention as claimed.

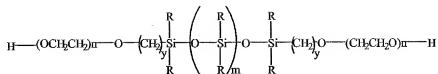
### DETAILED DESCRIPTION OF SOME EMBODIMENTS

5 As discussed above, the invention generally relates to foaming alcohol compositions with PEG-8 to PEG-12 linear dimethicone surfactants and in particular PEG-10 linear dimethicone surfactant. The compositions are useful as antimicrobial products and in particular handcare or skincare products.

#### PEG-8 to PEG-12 Linear Dimethicone Surfactants

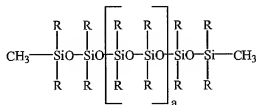
10 Surprisingly, it has been discovered that PEG-8 to PEG-12 linear dimethicone surfactants, and in particular PEG-10 linear dimethicone surfactant, are more effective at generating and stabilizing foam in alcohol compositions than dimethicone surfactants with the same PEG chain length but a different polymer architecture.

15 More particularly it has been discovered that linear block copolymers of PEG with polydimethylsiloxane (specifically with INCI names of PEG-8 dimethicone, PEG-10 dimethicone, and PEG-12 dimethicone) can produce a sufficient foam height to be used as the primary foaming component of a non-aerosol foaming alcohol compositions, which is not the case for copolymers with the same INCI  
20 names but different polymer architectures. For example, polymers with pendant PEG groups or other highly branched polymer structures, will not produce sufficient foam to be used as a primary foaming surfactant. In the case of PEG dimethicone copolymers, linear block copolymers refer to when polyethylene glycol chain units are attached to the terminal ends of the linear polydimethylsiloxane backbone:



where  $\text{R}=\text{CH}_3$  or  $\text{CH}_2\text{CH}_3$ ,  $m=4-20$  on average,  $y=1-5$  and  $n=8-12$  on average.

Pendant copolymers refer to linear polydimethylsiloxane polymers with PEG groups attached along the polydimethylsiloxane backbone and may or may not be attached to the terminal chain ends of the polydimethylsiloxane. Such pendant  
 5 copolymers are often referred to as having a comb or comb-like structure such as:



where R is independently =  $\text{CH}_3$ ,  $\text{CH}_2\text{CH}_3$ , or an ethoxylated alkyl chain (for  
 example  $\text{CH}_2\text{CH}_2\text{CH}_2\text{O}(\text{CH}_2\text{CH}_2\text{O})_n\text{H}$ ) attached directly to the silicone end group  
 10 and a = a repeating silicone group.

Some examples of commercially available PEG-8 to PEG-12 linear  
 dimethicone surfactants include Silsoft 810 (PEG-8) and Silsoft 870 (PEG-12) from  
 Momentive Performance Materials, and Silsurf DI-1010 (PEG-10) from Siltech. In  
 some embodiments, the dimethicone surfactant is preferably a PEG-10 linear  
 15 dimethicone surfactant.

The dimethicone surfactant can be present in the alcohol composition from  
 about 0.5 to about 10 wt.%, from about 1.0 to about 7 wt.% and from about 2 to  
 about 5 wt.%.

### Alcohol

In addition to water, the composition includes an alcohol. The alcohol is preferably a lower chain alcohol such as a C<sub>2</sub>-C<sub>4</sub> alcohol. Examples of suitable alcohols include ethanol, propanols, such as isopropanol and n-propanol, and

5 butanols. The alcohol is preferably ethanol.

The composition may contain one alcohol, or a mixture of two or more alcohols. The alcohol is preferably present in the composition in an amount of active alcohol from about 50 to about 90 wt. %, from about 54 to about 85 wt. %, and from about 60 to about 80 wt. %.

### 10 Skin Conditioner

The composition may optionally include at least one skin conditioner such as an emollient, humectant, occlusive agent, or other moisturizer to provide moisturization, skin softening, skin barrier maintenance, anti-irritation, or other skin health benefits. Some non-limiting examples of emollients include alkyl benzoate,

15 myristyl myristate, cetyl myristate, glyceryl dioleate, methyl laurate, PPG-9 laurate, lauryl laurylate allantoin, octyl palmitate, lanolin, propylene glycol, butylenes glycol, ethylene glycol monobutyl ether, glycerine, fatty acids, natural oils such as almond, mineral, canola, sesame, soybean, wheat germ, corn, peanut and olive oil, isopropyl myristate, myristyl alcohol, aloe vera, hydrolyzed silk protein, Vitamin E, stearyl

20 alcohol, isopropyl palmitate, sorbitol, amino acid complexes, hydrolyzed plant proteins, and polyethylene glycol. Some non-limiting examples of humectants include hydroxyethyl urea, agarose, urea, sodium PCA, arginine PCA, fructose, glucose, glutamic acid, glycerine, honey, lactose, maltose, polyethylene glycol, sorbitol and mixtures thereof. Some non-limiting examples of occlusive agents

include petrolatum, shea butter, avocado oil, balm mint oil, cod liver oil, mineral oil, trimyristin, stearyl stearate, synthetic wax, or mixtures thereof. Some non-limiting examples of other moisturizers include ethyl hexylglycerin, cholesterol, cystine, hyaluronic acid, keratin, lecithin, egg yolk, glycine, PPG-12, polyquaternium

5 polymers such as polyquaternium-11, benentrmonium chloride, dihydroxypropyl PEG-5 linoleammonium chloride, glycerol oleate, PEG-7 glyceryl cocoate, cocoglucoside, PEG-200 hydrogenated glyceryl palmate, panthenol, retinol, salicylic acid, vegetable oil, methyl gluceth-10, methyl gluceth-20, ethoxylated derivatives of skin conditioners such as glycereth-26 and ethoxylated shea butter, and mixtures

10 thereof. Finally, some non-limiting examples of anti-irritants include bisabolol and panthenol.

A person skilled in the art will recognize the different strengths of different skin conditioners and formulate accordingly. In some embodiments, the skin conditioner is preferably present in the composition in an amount from about 0.01 to

15 about 20 wt. %, from about 0.05 to about 15 wt. %, and from about 0.1 to about 10 wt. %.

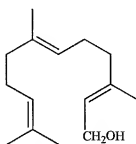
#### Terpenoid

The composition may optionally include a terpenoid. Terpenoids are defined as materials with molecular structures containing carbon backbones made up of

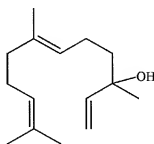
20 isoprene (2-methylbuta-1,3-diene) units. Isoprene contains five carbon atoms and therefore, the number of carbon atoms in any terpenoid is a multiple of five. It is believed that terpenoids assist in promoting the uptake of antimicrobial compounds and preservatives by cells of bacteria and fungi, thereby increasing the efficacy of the antimicrobial compound or preservative. See U.S. Pat. No. 6,319,958 and DE

195 23 320 which are incorporated by reference in their entirety. Some non-limiting examples of terpenoids include  $\alpha$ -terpinene, cineole, citral, citronellal, citronellol, farnesol, geraniol, limonene, linalool, methone, nerolidol, terpineol, camphene, menthone, myrcene, nerol, tetrahydrogeraniol, tetrahydrolinalool, apritone, and

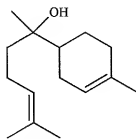
5 bisabolol. The terpenoid is preferably farnesol, nerolidol, bisabolol, or apritone.



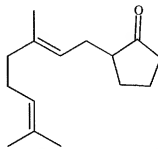
farnesol (CAS #4602-84-0)



nerolidol (CAS #7212-44-4)



bisabolol (CAS # 515-69-5)



apritone (CAS #68133-79-9)

The terpenoid is preferably present in the composition in an amount from about 0.005 to about 5 wt. %, from about 0.05 to about 2.5 wt. %, and from about

10 0.1 to about 1.5 wt. %.

#### Chelating Agent

The composition may optionally include a chelating agent. Examples of chelating agents include phosphonic acid and phosphonates, phosphates, aminocarboxylates and their derivatives, pyrophosphates, ethylenediamine and



- ethylenetriamine derivatives, hydroxyacids, and mono-, di-, and tri-carboxylates and their corresponding acids. Other chelating agents include nitroacetates and their derivatives, and mixtures thereof. Examples of aminocarboxylates include amino acetates and salts thereof. Suitable amino acetates include: N-
- 5 hydroxyethylaminodiacetic acid; hydroxyethylenediaminetetraacetic acid; nitrilotriacetic acid (NTA); ethylenediaminetetraacetic acid (EDTA); N-hydroxyethyl-ethylenediaminetriacetic acid (HEDTA); tetrasodium ethylenediaminetetraacetic acid (EDTA); diethylenetriaminepentaacetic acid (DTPA); and alanine-N,N-diacetic acid; n-hydroxyethyliminodiacetic acid; and the
- 10 like; their alkali metal salts; and mixtures thereof. Suitable aminophosphates include nitrilotrismethylene phosphates and other aminophosphates with alkyl or alkaline groups with less than 8 carbon atoms. Exemplary polycarboxylates iminodisuccinic acids (IDS), sodium polyacrylates, citric acid, gluconic acid, oxalic acid, salts thereof, mixtures thereof, and the like. Additional polycarboxylates
- 15 include citric or citrate-type chelating agents, polymeric polycarboxylate, and acrylic or polyacrylic acid-type chelating agents. Additional chelating agents include polyaspartic acid or co-condensates of aspartic acid with other amino acids, C<sub>4</sub>-C<sub>25</sub>-mono-or-dicarboxylic acids and C<sub>4</sub>-C<sub>25</sub>-mono-or-diamines. Exemplary polymeric polycarboxylates include polyacrylic acid, maleic/olefin copolymer, acrylic/maleic
- 20 copolymer, polymethacrylic acid, acrylic acid-methacrylic acid copolymers, hydrolyzed polyacrylamide, hydrolyzed polymethacrylamide, hydrolyzed polyamide-methacrylamide copolymers, hydrolyzed polyacrylonitrile, hydrolyzed polymethacrylonitrile, hydrolyzed acrylonitrile-methacrylonitrile copolymers, and the like.

The chelating agent may be present in an amount from about 0.01 to about 5 wt. %, from about 0.05 to about 3 wt. %, and from about 0.1 to about 1.5 wt. %.

#### Preservatives

The composition may optionally include a preservative. Generally,

- 5 preservatives fall into specific classes including phenolics, halogen compounds, quaternary ammonium compounds, metal derivatives, amines, alkanolamines, nitro derivatives, biguanides, analides, organosulfur and sulfur-nitrogen compounds, alkyl parabens, and miscellaneous compounds. Some non-limiting examples of phenolic antimicrobial agents include pentachlorophenol, orthophenylphenol, chloroxylenol,
- 10 p-chloro-m-cresol, p-chlorophenol, chlorothymol, m-cresol, o-cresol, p-cresol, isopropyl cresols, mixed cresols, phenoxyethanol, phenoxyethylparaben, phenoxyisopropanol, phenyl paraben, resorcinol, and derivatives thereof. Some non-limiting examples of halogen compounds include trichlorohydroxy diphenyl ether (Triclosan), sodium trichloroisocyanurate, sodium dichloroisocyanurate,
- 15 iodine-poly(vinylpyrrolidin-one) complexes, and bromine compounds such as 2-bromo-2-nitropropane-1,3-diol, and derivatives thereof. Some non-limiting examples of quaternary ammonium compounds include benzalkonium chloride, benzethonium chloride, behentrimonium chloride, cetrimonium chloride, and derivatives thereof. Some non-limiting examples of amines and nitro containing
- 20 compounds include hexahydro-1,3,5-tris(2-hydroxyethyl)-s-triazine, dithiocarbamates such as sodium dimethyldithiocarbamate, and derivatives thereof. Some non-limiting examples of biguanides include polyaminopropyl biguanide and chlorhexidine gluconate. Some non-limiting examples of alkyl parabens include methyl, ethyl, propyl and butyl parabens. The preservative is preferably present

in the composition in an amount from about 0 to about 3 wt. %, from about 0.1 to about 2 wt. %, and from about 0.2 to about 1 wt. %.

#### Thickener

The composition may optionally include a thickener. Exemplary thickeners

5 include (1) cellulosic thickeners and their derivatives, (2) natural gums, (3) starches, (4) stearates, and (5) fatty acid alcohols. Some non-limiting examples of cellulosic thickeners include carboxymethyl hydroxyethylcellulose, cellulose, hydroxybutyl methylcellulose, hydroxyethylcellulose, hydroxypropylcellulose, hydroxypropyl methyl cellulose, methylcellulose, microcrystalline cellulose, sodium cellulose

10 sulfate, and the like. Some non-limiting examples of natural gums include acacia, calcium carrageenan, guar, gelatin, guar gum, hydroxypropyl guar, karaya gum, kelp, locust bean gum, pectin, sodium carrageenan, tragacanth gum, xanthan gum, and the like. Some non-limiting examples of starches include oat flour, potato starch, wheat flour, wheat starch, and the like. Some non-limiting examples of

15 stearates include PEG-150 distearate, methoxy PEG-22/dodecyl glycol copolymer, and the like. Some non-limiting examples of fatty acid alcohols include caprylic alcohol, cetearyl alcohol, lauryl alcohol, oleyl alcohol, palm kernel alcohol, and the like.

The amount of thickener in the composition depends on the desired viscosity

20 of the composition. The composition preferably has a viscosity low enough to pump through a foamer such as an Airspray foamer and allow foaming.

#### Additional Functional Ingredients

Additional functional ingredients may be used to improve the effectiveness of the composition. Some non-limiting examples of such additional functional

ingredients include skin feel improvers, antioxidants, fragrances, dyes, and mixtures thereof.

#### Skin Feel Improver

The composition may optionally include a skin feel improver for enhancing

5 the "feel" of the composition on a user's skin or hands. For example, it may be undesirable for a composition to have a scaly or gritty texture when applied to a user's skin or after the multiple applications of the composition. Some non-limiting examples of skin feel improvers include silicone copolymers such as amodimethicone, cyclomethicone, bis-PEG/PPG-20/20 dimethicone, and

10 stearoxytrimethylsilane, naturally occurring or synthetic fatty acid esters or ethers, and polyalkylene glycols.

If a skin feel improver is included, it is preferably present in the composition in an amount from about 0.001 to about 5 wt. %, from about 0.01 to about 3 wt. %, and from about 0.1 to about 2 wt. %.

#### 15 Antioxidant

The composition may optionally include an antioxidant for improved skin condition through the removal of free radicals, and improved product stability. Some non-limiting examples of antioxidants include retinol and retinol derivatives, ascorbic acid and ascorbic acid derivatives, BHA, BHT, betacarotene, cysteine,

20 erythorbic acid, hydroquinone, tocopherol and tocopherol derivatives, and the like.

If an antioxidant is included, it is preferably present in the composition in an amount from about 0.001 to about 2 wt. %, from about 0.01 to about 1 wt. %, and from about 0.05 to about 0.5 wt. %.

## Fragrance

- The composition may optionally include a fragrance. Examples of possible fragrances include natural oils or naturally derived materials, and synthetic fragrances such as hydrocarbons, alcohols, aldehydes, ketones, esters, lactones,
- 5 ethers, nitriles, and polyfunctionals. Non-limiting examples of natural oils include the following: basil (*Ocimum basilicum*) oil, bay (*Pinento acris*) oil, bce balm (*Monarda didyma*) oil, bergamot (*Citrus aurantium bergamia*) oil, cardamom (*Elettaria cardamomum*) oil, cedarwood (*Cedrus atlantica*) oil, chamomile (*Anthemis nobilis*) oil, cinnamon (*Cinnamomum cassia*) oil, citronella (*Cymbopogon*
- 10 *nardus*) oil, clary (*Salvia sclarea*) oil, clove (*Eugenia caryophyllus*) oil, cloveleaf (*Eugenia caryophyllus*) oil, *Cyperus esculentus* oil, cypress (*Cupressus sempervirens*) oil, *Eucalyptus citriodora* oil, geranium maculatum oil, ginger (*Zingiber officinale*) oil, grapefruit (*Citrus grandis*) oil, hazel (*Corylus avellana*) nut oil, jasmine (*Jasminum officinale*) oil, *Juniperus communis* oil, *Juniperus oxycedrus*
- 15 tar, *Juniperus virginiana* oil, kiwi (*Actinidia chinensis*) water, lavandin (*Lavandula hybrida*) oil, lavender (*Lavandula angustifolia*) oil, lavender (*Lavandula angustifolia*) water, lemon (*Citrus medica limonum*) oil, lemongrass (*Cymbopogon schoenanthus*) oil, lime (*Citrus aurantifolia*) oil, linden (*Tilia cordata*) oil, linden (*Tilia cordata*) water, mandarin orange (*Citrus nobilis*) oil, nutmeg (*Myristica*
- 20 *fragrans*) oil, orange (*Citrus aurantium dulcis*) flower oil, orange (*Citrus aurantium dulcis*) oil, orange (*Citrus aurantium dulcis*) water, patchouli (*Pogostemon cablin*) oil, peppermint (*Menthe piperita*) oil, peppermint (*Menthe peperita*) water, rosemary (*Rosmarinus officinalis*) oil, rose oil, rose (*Rosa damascena*) extract, rose (*Rosa multiflora*) extract, rosewood (*Aniba rosaedora*) extract, sage (*Salvia officinalis*)

oil, sandalwood (*Santalum album*) oil, spearmint (*Menthe viridis*) oil, tea tree (*Melaleuca alternifolia*) oil, and ylang ylang (*Cananga odorata*) oil. Some non-limiting examples of synthetic hydrocarbon fragrances include caryophyllene,  $\beta$ -farnesene, limonene,  $\alpha$ -pinene, and  $\beta$ -pinene. Some non-limiting examples of synthetic alcohol fragrances include bacdanol, citronellol, linalool, phenethyl alcohol, and  $\alpha$ -terpineol (R=H). Some non-limiting examples of synthetic aldehyde fragrances include 2-methyl undecanal, citral, hexyl cinnamic aldehyde, isocyclocitral, linal, and 10-undecenal. Some non-limiting examples of synthetic ketone fragrances include cashmeran,  $\alpha$ -ionone, isocyclemone E, koavone, muscone, and tonalide. Some non-limiting examples of synthetic ester fragrances include benzyl acetate, 4-*t*-butylcyclohexyl acetate (cis and trans), cedryl acetate, cyclacet, isobornyl acetate, and  $\alpha$ -terpinyl acetate (R=acetyl). Some non-limiting examples of synthetic lactone fragrances include coumarin, jasmine lactone, muskalactone, and peach aldehyde. Some non-limiting examples of synthetic ether fragrances include ambroxan, anther, and galaxolide. Some non-limiting examples of synthetic nitrile fragrances include cinnamonnitrile and gertonitrile. Finally, some non-limiting examples of synthetic polyfunctional fragrances include amyl salicylate, isoeugenol, hedione, heliotropine, lyral, and vanillin.

The composition may include a mixture of fragrances including a mixture of natural and synthetic fragrances. The fragrance can be present in a composition in an amount up to about 5 wt. %, preferably from about 0.01 to about 3 wt. %, from about 0.05 to about 1 wt. %, and from about 0.1 to about 0.2 wt. %.

## Dye

- The composition may optionally include a dye. Examples of dyes include any water soluble or product soluble dye, any FD&C or D&C approved dye. The dye can be present in an amount up to about 0.5 wt. %, preferably from about
- 5 0.00001 to about 0.1 wt. %, from about 0.0001 to about 0.01 wt. %, and from about 0.0001 to about 0.0005 wt. %.

## Compositions

The non-aerosol alcohol compositions are especially useful as hand and skincare compositions for reducing microorganisms on the target surface.

- 10 In some embodiments, the composition includes less than about 10%, less than about 5% or less than about 1% any additional surfactant. The use of additional surfactant may be limited because the selected dimethicone surfactants are capable of producing and maintaining foam without needing help from additional surfactants.

- 15 In some embodiments, the composition includes less than about 10%, less than about 5% or less than about 1% any additional silicone materials besides the PEG-8, PEG-10, or PEG-12 linear dimethicone surfactant.

In some embodiments, the composition includes less than about 10%, less than about 5% or less than about 1% any foam stabilizers.

- 20 In some embodiments, the composition may be free or substantially free of additional surfactant, additional silicone material, or foam stabilizer. In some embodiments, the composition may be free or substantially free of a fluorosurfactant.

The composition may be provided as a water thin liquid, structured liquid or emulsion. The composition is preferably provided as a ready to use composition, meaning that the composition is provided in a way that can be applied without needing to dilute it first.

5 Packaging and Dispensers

The composition may be provided in various packaging sizes. Examples of packaging sizes include 1.5 oz, 500 ml and 1 liter bottles. The selected packaging preferably has a pump head foamer. Examples of commercially available pump head foamers include the F2 foamer from Rexam PLC (London, England, formerly  
10 Airspray), and the RF-17 Palm Foamer from Rieke Corporation (Auburn, Indiana).

Definitions

For the following defined terms, these definitions shall be applied, unless a different definition is given in the claims or elsewhere in this specification.

All numeric values are herein assumed to be modified by the term "about,"  
15 whether or not explicitly indicated. The term "about" generally refers to a range of numbers that one of skill in the art would consider equivalent to the recited value (i.e., having the same function or result). In many instances, the term "about" may include numbers that are rounded to the nearest significant figure.

Weight percent, percent by weight, % by weight, wt %, and the like are  
20 synonyms that refer to the concentration of a substance as the weight of that substance divided by the weight of the composition and multiplied by 100.

The recitation of numerical ranges by endpoints includes all numbers subsumed within that range (e.g. 1 to 5 includes 1, 1.5, 2, 2.75, 3, 3.80, 4 and 5).



As used in this specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to a composition containing "a compound" includes a mixture of two or more compounds. As used in this specification and the appended  
5 claims, the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise.

For a more complete understanding of the invention, the following examples are given to illustrate some embodiment. These examples and experiments are to be understood as illustrative and not limiting. All parts are by weight, except where it is  
10 contrarily indicated.

#### EXAMPLES

##### Example 1 – Silicone Surfactant Screening

Example 1 shows various silicone surfactants and their ability to generate a stable foam. The foaming ability of the silicone surfactants was evaluated using the  
15 following foam height screening procedure.

Stock Solution Preparation: A solution consisting of 75.6% Ethanol SDA 40B (190 proof, 99.5% Active) and 24.4% water was prepared.

Sample Preparation: To a 20mL vial, approximately 0.35g of silicone surfactant and 9.65g Stock solution were weighed. The solution was then mixed until a  
20 homogeneous solution was achieved.

Foam Height Screening: To screen the foam height of each solution, a small portion (~1mL) of the prepared solution was placed into a 2oz bottle with an Airspray foaming pump head, rinsed around, and discarded. After the rinsing of the bottle, the remaining contents of the sample preparation were then transferred into the 2oz

- bottle with an Airspray foaming pump head. The foaming pump head was primed until liquid or foam was generated through the foamer head. Up to three additional pumps were performed to ensure that the initial solution had been evacuated through the pump. After priming the pump, three additional pumps were performed,
- 5 directing the material into a 20 mL glass vial. The height of the foam above the liquid line was immediately measured in millimeters using a ruler. The process was repeated one additional time and the two foam height measurements were averaged.

The results are shown in Table 1.

Table 1 – Silicone Surfactant Screening

Mfg.	Name	INCI Name	chemistry type / structure	Avg. Foam Height (mm)
Noveon	Silsense CA2	dimethicone PEG-7 succinate	pendant	9.5
Noveon	Silsense Q Plus	silicone quaternium-8	pendant	10.5
Novcon	Silsense Copolyol 7	PEG-33 and PEG-14 and PEG-8 dimethicone	pendant	9
Noveon	Silsense Copolyol 1	PEG-33 and PEG-8 dimethicone and PEG-14	pendant	8.5
Siltech	Silube CS-1	PEG-7 dimethiconesuccinate	pendant	6.5
Siltech	Silphos A-100	silicone polyether phosphate esters*	pendant	5
Siltech	Silsurf B-208	PEG-8 dimethicone	pendant	5
Siltech	Silsurf A-208	PEG-8 dimethicone	pendant	5.5
Siltech	Silsurf DI-1010	PEG-10 dimethicone	linear	25
Siltech	Silsurf D212-CG	PEG-12 dimethicone	pendant	9
Siltech	Silquat AD	silicone quaternium-8	pendant	4
Siltech	Silquat J208-1B	PEG-8 distearonium chloride PG-dimethicone	pendant	8
Degussa	EM 97	bis-PEG/PPG-14/14 dimethicone, cyclopentasiloxane	alpha, omega polyethersiloxane linear	11.5
Degussa	85	bis-PEG/PPG-16/16 dimethicone, caprylic/capric, triglyceride	with the addition of caprylic/capric acid triglyceride linear	15
Degussa	B 8852	PEG/PPG-4/12 dimethicone	pendant	
Degussa	B 8832	bis-PEG/PPG-20/20 dimethicone	linear	18

Grant Industries	Gransurf 71	PEG-11 methyl ether dimethicone	pendant	9
Grant Industries	Gransurf 77	PEG-10 dimethicone	pendant	8
Waker	Waker-Belsil DMC 6031	PEG/PPG-25/25 dimethicone	pendant	8
Waker	Waker-Belsil DMC 6038	bis-PEG 15 methyl ether dimethicone	methyl ether endcapped linear	3
Waker	DMC3071VP	cetyl PEG/PPG-15/15 butyl ether dimethicone	pendant	5
Shin Etsu	KF-6100	polyglyceryl-3 disiloxane dimethicone	pendant	0
Shin Etsu	KF-6017	PEG-10 dimethicone	pendant	12
Shin Etsu	KF-6104	polyglyceryl-3 polydimethylsilylhexethyl dimethicone	pendant	0
Shin Etsu	KF-6028	PEG-9 polydimethylsiloxane ethyl dimethicone	pendant	8
Shin Etsu	KF-6015	PEG-3 dimethicone		0
Shin Etsu	KF-6013	PEG-9 dimethicone	pendant	15.5
GE Silicone	Nuwet 300	aminommodified silicone-polyether copolymer *	pendant	11
GE Silicone	L-7657	PEG dimethicone *	pendant	9
GE Silicone	Silsoft A424 conditioner	dimethicone bisamino hydroxyethylhydripropyl copolyol / TEA stearate	pendant	0
GE Silicone	L-7001	siloxane polyalkyleneoxide copolymer	pendant	5
GE Silicone	Silsoft 430 dimethicone copolyol	PEG/PPG 20/23 dimethicone	pendant	18
Momentive	Silsoft 805	PEG-8 dimethicone	pendant	17
GE Silicone	Silsoft 840	PEG-8 dimethicone	pendant	7.5
GE Silicone	Silsoft 810	PEG-8 dimethicone	linear	23.5
Momentive	Silsoft 870	PEG-12 dimethicone	linear	24.5
GE Silicone	Silsoft 875	PEG-12 dimethicone	pendant	9
GE Silicone	Silsoft 895	PEG-17 dimethicone	pendant	9.5
Momentive	Silsoft 900	PPG-12 dimethicone	pendant	16.5
Momentive	1188 01P	dimethicone copolyol	pendant	10.5
Momentive	1288 01P	dimethicone copolyol	pendant	13

Rita	Ritasil SP100S	PEG-12 dimethicone	pendant	17
Rita	Ritasil SW3050	cetyl PEG-PPG 10/1 dimethicone	pendant	0
Clariant	Silcare Silicone SLA	trideceth-9 PG amodimethicone (and) trideceth-12	pendant	1
Biosil	Biosil Basics SPQ	silicone quaternium-2 panthenol succinate	pendant	3.5
Biosil	Biosil Basics DL-30	dimethiconol panthenol	pendant	0
Biosil	Bioplex Cetyl Sil S	cetyl triethylammonium dimethicone PEG-8 succinate	pendant	4
Pbconix chemical	DCF-12	PEG-12 dimethicone	pendant	6

\* no INCI name has been given for the polymers

Table 1 shows that only the linear dimethicones are able to produce a foam height greater than 20 mm. Exemplary dimethicone surfactants in Table 1 with a foam height of greater than 20 mm include Silsurf DI-1010 from Siltech, Silsoft 810 from GE Silicone, and Silsoft 870 from Momentive.

#### Example 2 – Foam Height vs. Silicone Surfactant Concentration

Example 2 determined the effect of dimethicone surfactant concentration on the foam height. For this example, the foam height was measured using the following test:

Stock Solution Preparation: A solution was prepared with the following formula:

Stock Solution	(g)
Ethanol SDA 40 B (190 Proof, 99.5% Active)	811.11
Farnesol	2.78
Bisabolol	1.11
Ethylhexyl glycerin	3.33
Water	181.67

The following amounts were added to 60 mL jars. The silicone surfactants used were Silsurf DI-1010, Silsoft 810, and Silsoft 870.

Sample Preparation: To a 60 mL jar,

Sample	1	2	3	4	5	6	7
Stock solution (g)	22.500	45.00	45.00	45.00	45.00	45.00	45.00
Silicone surfactant (g)	0.125	0.50	1.00	1.50	1.75	2.50	5.00
Silicone surfactant (wt.%)	0.5	1	2	3	3.5	5	10
Water (g)	2.375	4.50	4.00	3.50	1.25	2.50	0.00

- Foam Height Screening: To screen the foam height of each solution, a small portion (~1mL) of the prepared solution was used to rinse a 2oz bottle with an Airspray foaming pump head and discarded. After rinsing the bottle, the remaining contents of the sample preparation were then transferred into the 2oz bottle with an Airspray foaming pump head. The foaming pump head was primed until liquid or foam was generated through the foamer head. Up to three additional pumps were performed to ensure that the rinse solution had been evacuated through the pump. After priming the pump, three additional pumps were performed, directing the material into a 20mL glass vial. The height of the foam above the liquid line was immediately measured in millimeters using a ruler. The process was repeated and the two foam height measurements were averaged. The results are shown in Table 2.

Table 2 – Foam Height (mm)

Sample	1	2	3	4	5	6	7
Silsoft 810	12	11.5	20	24	25.5	26	26
Silsurf DI-1010	14.5	22.5	23.5	24	25	26	26.5
Silsoft 870	13	17	23.5	25.5	26	26	27

- Table 2 shows that 0.5-1 gram of silicone surfactant (samples 2 and 3) is preferred in order to generate 20 mm of foam.

The foregoing summary, detailed description, and examples provide a sound basis for understanding the invention, and some specific example embodiments of the invention. Since the invention can comprise a variety of embodiments, the

above information is not intended to be limiting. The invention resides in the claims.

## WHAT IS CLAIMED IS:

1. A non-aerosol foaming antimicrobial composition comprising:
  - a) a foaming agent comprising a PEG-8 to PEG-12 linear dimethicone surfactant having an average foam height of greater than 20 mm;
  - 5 b) from about 50 to about 90 wt.% of a C<sub>2</sub>-C<sub>4</sub> alcohol; and
  - c) waterwherein there is less than about 5 wt.% of an additional surfactant.
2. The antimicrobial composition of claim 1, further comprising from about 0.01 to about 20 wt.% of a skin conditioner.
- 10 3. The antimicrobial composition of claim 2, wherein the skin conditioner is selected from the group consisting of ethylhexylglycerin, hydroxyethylurea, urea, panthenol, glycerin, isopropyl myristate, propylene glycol, tocopheryl acetate, polyquaternium-11 and mixtures thereof.
4. The antimicrobial composition of claim 1, further comprising an additional  
15 ingredient selected from the group consisting of skin feel improvers, antioxidants, fragrances, dyes, and mixtures thereof.
5. The antimicrobial composition of claim 1, wherein the foam agent is a PEG-10 linear dimethicone surfactant.
6. The antimicrobial composition of claim 1, wherein the composition is free of  
20 an additional surfactant.
7. A foaming antimicrobial composition comprising:
  - a) a foaming agent comprising a PEG-10 linear silicone surfactant having an average foam height of greater than 20 mm;
  - b) from about 50 to about 90 wt.% of a C<sub>2</sub>-C<sub>4</sub> alcohol; and

c) water

wherein there is less than about 5 wt.% additional surfactant.

8. The antimicrobial composition of claim 7, further comprising from about 0.005 to about 5 wt.% of a terpenoid.

5 9. The antimicrobial composition of claim 7, further comprising an additional ingredient selected from the group consisting of skin feel improvers, antioxidants, fragrances, dyes, and mixtures thereof.

10. The antimicrobial composition of claim 7, wherein the composition is substantially free of a foam stabilizer.

10 11. The antimicrobial composition of claim 7, wherein the composition is substantially free of an additional silicone material.

12. The antimicrobial composition of claim 7, further comprising a skin conditioner selected from the group consisting of ethylhexylglycerin, hydroxyethylurea, urea, panthenol, glycerin, isopropyl myristate, propylene glycol, tocopheryl acetate, polyquaternium-11 and mixtures thereof.

15 13. A foaming antimicrobial composition comprising:

a) a foaming agent comprising a PEG-8 to PEG-12 linear dimethicone surfactant having an average foam height of greater than 20 mm;

b) from about 60 to about 80 wt.% of a C<sub>2</sub>-C<sub>4</sub> alcohol;

20 c) from about 0.1 to about 10 wt.% of a skin conditioner selected from the group consisting of glycerin, ethylhexyl glycerin, hydroxyethyl urea, urea, panthenol, and mixtures thereof; and

d) water.

14. The antimicrobial composition of claim 13, further comprising from about



0.005 to about 5 wt.% of a terpenoid.

15. The antimicrobial composition of claim 13, further comprising an additional ingredient selected from the group consisting of skin feel improvers, antioxidants, fragrances, dyes, and mixtures thereof.

5 16. The antimicrobial composition of claim 13, wherein the composition is substantially free of a foam stabilizer.

17. The antimicrobial composition of claim 13, wherein the composition is substantially free of an additional silicone material.

10 18. The antimicrobial composition of claim 13, wherein the foaming agent is PEG-10 linear dimethicone.

19. A foaming antimicrobial composition consisting essentially of:

a) a foaming agent comprising a PEG-8 to PEG-12 linear dimethicone surfactant having an average foam height of greater than 20 mm;

b) from about 54 to about 85 wt.% of at least two C<sub>2</sub>-C<sub>4</sub> alcohols;

15 c) from about 0.01 to about 20 wt.% of a chelating agent;

d) from about 0.01 to about 20 wt.% of a skin conditioner selected from the group consisting of glycerin, isopropyl myristate, propylene glycol, tocopheryl acetate, polyquaternium-11, and mixtures thereof;

f) from about 0 to about 3 wt.% of a paraben; and

20 g) water.

20. The antimicrobial composition of claim 19, further comprising an additional ingredient selected from the group consisting of skin feel improvers, antioxidants, fragrance, dye, and mixtures thereof.

21. The antimicrobial composition of claim 19, wherein the foam agent is a PEG-10 linear dimethicone surfactant.